Re: op−amps with wide open−loop bandwidth ?

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- *From*: John Popelish <jpopelish@xxxxxxxx>
- *Date*: Fri, 17 Mar 2006 10:59:42 −0500

Dave Moore wrote:
(snip)

> In the past I've plunked a variety of op−amps into pre−designed
> circuits and though analysis of those designs didn't reveal anything
> to me that could account for the obvious difference in tone
> (other than some near−instability issues), I hope do a better
> study and compare the op−amps in circuits that are more
> individually optimized. Perhaps Kevin is right and it's all been
> done before, but regardless, I like to prove things for myself.

You are missing my point.

I'll start over.

Tube amplifiers tend to be made with as few tubes as possible, for obvious reasons of cost, size and complexity. This usually means that each stage up to the final output is a single tube, with minimal feedback around it. When such stages are over driven, as the output voltage approaches the highest and lowest possible values, the stage gain drops off smoothly and cleanly and the output slides in to a nearly steady value, and waits for the signal to reverse directions. And then the gain rises smoothly and the voltage takes off cleanly in the other direction. Saturation of the output is a graceful and simple process, as is recovery from saturation.

Opamps are completely different. They are complicated systems of up to dozens of devices that all work together as long as inputs stay inside the input common mode range, and the output is not saturated fully positive or negative, or asked to change voltage faster than it is able (exceed the slew rate limit). Under these conditions, an opamp is a programmable device, It performs an almost unlimited number of functions that are very strictly controlled by the input and feedback networks connected around them.

However, if the input common mode specs are violated, or the output is allowed to saturate (because the input and feedback networks in conjunction with the input signal asked it to), or to a lesser extent, if the output is asked to change voltage faster than it is able, the internal circuits go to hell. And when the input signal and external network, once again, puts the inputs back inside the common mode range, or asks the output to come out of saturation, or slows the request for output voltage change to within the slew rate limit, There is a period of time (sometimes surprisingly long) that the opamp struggles to regain normal operation, and can do all kinds of unpleasantly sounding things.

So, while it is perfectly good to have single active device stages be slapped with overdrive, and use them to obtain a pleasing sound coloration, this is not the way to do such coloration with opamps. All the "effects"

have to be built into the input and feedback networks, so that the opamp is externally programmed to produce the colored overdrive sound without it actually ever being over driven, itself. If this is done correctly, there is a range of effects limited only by your imagination and time to experiment, that, if the opamp stays in its normal operating conditions every microsecond, it will have almost nothing to do with the sound quality. It will just be following its program. If you change opamps, the limits that it can tolerate, and still be an opamp every microsecond, change, and allow you different freedom as far as the program (external network) goes but it still won't produce ant "sound" that is separate from the program.

So I don't approach a sound effect task by surveying opamps for their sound, I design the input and feedback networks that produce the programming I want to hear, and then figure out what opamp specs are needed to be able to execute that program. Or I build the networks and check with test equipment that the opamp is able to keep up with it.

This is how engineers "see" opamps in a circuit, and why you are receiving so much static from them, here, when you say you want to listen to some opamps to hear what they sound like. An opamp you can hear is an opamp that is not being an opamp all the time. Some of the time, it is a failure.

Now, if you have a particular programming network in mind and a signal you want to pass through it, that you want to listen to, we can help you figure out what opamp specs are required to carry out that program.
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